

soon as, with the increase in size and complexity of the spore-bearing plant, a vegetation capable of affording shade came into existence, the conditions suitable for the persistence of the more primitive, alga-like, sexual stage in the life history would be present. The latter has, of course, also been modified in various ways.

In the concluding portion of this paper, the theories of antithetic and homologous alternation are compared by considering the explanations they afford of the facts. The general conclusion reached is that, while both afford a *possible* explanation of the facts of alternation in archegoniate plants, any evidence which would render one or the other untenable is wanting. The reasons on which either is considered more probable depend on the views held as to the lines of descent which have been followed, and the degree to which the different groups of archegoniate plants have had a common origin, or represent actual steps in the process of evolution of the sporophyte. Under these circumstances the question must be regarded as an open one until the available lines of evidence have been more fully investigated.

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“Experimental Observations on the early Degenerative Changes in the Sensory End Organs of Muscles.” By F. E. BATTEN, M.D. Communicated by Professor VICTOR HORSLEY, F.R.S. Received February 17,—Read March 3, 1898.

(Abstract.)

The experiments described in the following paper were undertaken in order to show, firstly, that degeneration occurred in the first place in that part of the neuron most remote from the cell, and secondly, to reproduce within the muscle-spindle, if possible, certain changes which had been shown by the author to be present in the case of *tabes dorsalis* in man.

The method of experiment was as follows:—Dogs were selected, and the mixed roots of the 5th cervical to the 1st dorsal inclusive were divided, and the animals killed at the following periods after section of the nerve, viz., 24, 48, 72, 96, 120 hours, and 7 and 14 days.

From the biceps muscle after being treated by Sihler's method muscle-spindles were teased out; some of these were mounted without further staining, others were treated by Marchi's method, others were stained by the Marchi-Pal method.

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The normal muscle-spindle showed the existence of a spiral form of nerve termination in connection with the large nerve fibre that passes to the equatorial region of the spindle, this spiral nerve termination is shown to wind round a muscle fibre, which at this point contains large cells, at one point completely filling the muscle fibre and interrupting the striation, but tailing off in either direction so that the cells come to lie in the centre of the muscle fibre. It is then shown that in twenty-four hours after section of the nerve changes may be seen in this spiral termination, and that in forty-eight hours after section of the nerve the spiral is no longer recognisable, oval and elongated granular cells now making their appearance. Changes then appear in the large intramuscular cells. The musculo-spiral nerve was then examined in three parts of its course, (1) in the muscle, (2) at its entrance into the muscle, (3) near its origin, at various periods after section of the nerve. No obvious change could be found in the nerve till between the fifth and seventh day after section of the nerve, and at that time degeneration was as marked in the central portion of the nerve as in the peripheral (Marchi and Marchi-Pal methods were used).

The existence of a spiral form of nerve termination has already been described by Ruffini as encircling a muscle fibre, and other authors refer to a spiral within the muscle-spindle; but it has not, I believe, been shown that the spiral encircles the large intramuscular cells first described by Kühne.

Early degeneration was first described by Cattaneo in the nerve termination in the musculo-tendon organ twenty hours after section of the nerve. Both these investigators used the gold-chloride method, in the present research Sihler's method has been used.

The results of the research have been to show—

(1) That within the muscle-spindle a spiral form of nerve termination exists surrounding a fine muscular fibre, in the centre of which are large, clear, non-nucleated cells.

(2) That changes take place in the spiral in twenty-four hours after section of the nerve, and that such changes become marked in forty-eight hours.

(3) That degeneration of the medullated sheath of the nerve takes place in the whole course of the nerve at the same time after section of the nerve.

(4) That no fatty change could be demonstrated in the intramuscular cells by the Marchi method similar to those found in the case of *tabes dorsalis* in man.